DOCUMENT RESUME

ED 414 199		SE 061 013
AUTHOR	Yore, Larry D.	
TITLE	Leadership Interns in Undergraduate Elementary School Science Education Programs.	
PUB DATE	1997-11-13	
NOTE	24p.; Paper presented at the Annual Meeting of the School Science and Mathematics Association (Milwaukee, WI, November 13-15, 1997).	
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)	
EDRS PRICE	MF01/PC01 Plus Postage.	
DESCRIPTORS	Action Research; Communication Skills; *Course Evaluation; Educational Assessment; Educational Change; Elementary Education; *Elementary School Science; Evaluation; Foreign Countries; Higher Education; Inservice Teacher Education; *Internship Programs; Preservice Teacher Education; Qualitative Research; Science Instruction; Teacher Collaboration; Undergraduate Study	
IDENTIFIERS	University of Victoria BC	

ABSTRACT

This paper reports on an on-going action research study of the elementary school science education courses at the University of Victoria in Canada. The Department of Social and Natural Sciences requires that professors evaluate their teaching effectiveness annually using a variety of methods such as student evaluations, peer observations, course outline analyses, and other methods approved by the department chair. This requirement provides an excellent opportunity to conduct action research to document teaching, to reflect upon teaching, to improve practice, and to revise course outlines based on multiple sources of data. The leadership component of a course entitled Science Instruction in the Elementary School is the focus of this paper. This course attempts to enhance science education leadership in five ways: (1) develop knowledge of science education reforms, curricula, instruction, and assessment; (2) develop communication skills (oral and written); (3) workshop experience; (4) collaborative planning; and (5) reflective practice. All assignments except the final examination address these issues. The specific focus of this action research was the teaching internship in science. The effectiveness of the internship was documented with instructional artifacts produced by the interns (unit plans, lesson plans, class hand-outs), professors' journal notes and classroom observations, school principal and classroom teacher comments, and course evaluation comments. Qualitative analyses of these data sources revealed that the positive benefits of this internship include an improved relationship with the school, enhanced self-concept and teaching effectiveness of interns, a professor who can describe the teaching effectiveness of all elementary school science majors, and informal professional development for classroom teachers and professors. The negative aspects of the internship were that not all peer-pairs were effective collaborators, the school experience placed significant time demands on university students and professors, professional development experiences could be more formalized, and follow-up activities should be planned. (Author/DKM)

Leadership Interns in Undergraduate Elementary School Science Education Programs

Larry D. Yore
Department of Social and Natural Sciences
University of Victoria

Introduction

This paper reports on an on-going action research study of the elementary school science education courses at the University of Victoria. The Department of Social and Natural Sciences requires that professors evaluate their teaching effectiveness annually using a variety of methods—student evaluations, peer observations, course outline analyses, and other methods approved by the department chair. This requirement provides an excellent opportunity to conduct action research to document teaching, to reflect on teaching, to improve practice, and to revise course outlines based on multiple sources of data. The leadership component of Ed-E 445A: Science Instruction in the Elementary School is the focus of this paper.

Background

Elementary science teacher education has lacked a consistent focus and direction over the last 10-15 years. A variety of short-term reforms occurred since the hands-on science reform of the 1960s, but none had major influence on how elementary teachers were educated or how elementary science was taught to young children. A quick inspection of 1980s national and regional conferences on science teaching and science teacher education reveals a loose collection of interesting ideas and effective programs

Paper presented at the Annual School Science and Mathematics Association Conference, Milwaukee, WS, November 13-15, 1997.

without a central clear philosophical, psychological and pedagogical framework. The *National Science Education Standards* (NRC, 1996) explicitly addressed this lack of clarity by including teaching, assessment, content, program and professional development standards. The science standards taken in conjunction with the *National Board for Professional Teaching Standards* (NBPTS, 1994) and the Report of the *National Commission on Teaching and America's Future* (NCTAF) Darling-Hammond, 1996 reaffirm the importance of teachers, teaching, and hands-on/minds-on learning as primary influences on student's thinking, academic achievement, emotional disposition, and science literacy and has renewed the emphasis on teaching and teacher education research.

Historically, elementary science education courses could be classified into two categories: content-oriented or thinking-oriented (Kennedy, 1990). Shulman (1987) encouraged designers of teacher education programs to articulate and coordinate the content knowledge, pedagogical knowledge, and content-pedagogical knowledge components of a program. The lack of articulation and coordination of these components between faculties of science and education and among departments within faculties of education resulted in students entering science methods courses and clinical teaching experiences and in novice teachers entering the teaching profession with diverse scientific and pedagogical knowledge. Surveys of elementary teachers indicate that practicing teachers believe they lack appropriate content knowledge. These surveys also indicate that practicing teachers do not value their preservice science education courses and believe science education leadership is lacking in elementary schools. Practical experience with curriculum committees and science teacher associations indicates a lack of elementary teachers willing to accept leadership responsibilities. These reflections indicate that science and science education components of elementary teacher education programs are not effective in that they do not address the perceived needs of real classroom teachers, do not reflect reasonable

expectations and current conditions of real classrooms, do not provide real depth of understanding, do not convince preservice teachers of their real value and, most importantly, do not produce sufficient science education leaders. In part, this is due to the disconnected internal relations within the university but it is also due to the disconnected nature of the program's campus-based and field-based components (Roth & Pipho, 1990; Yager & Penick, 1990).

The 1960s science education reform produced a series of false dichotomies, process/product, child-centered/subject-centered, structured/unstructured, basics/higher-order thinking, etc. Contemporary perspectives must address these false propositions—all teaching must "merge commitment to students with allegiance to knowledge at all grade levels" (NBPTS, 1994, p. 10); integrate knowledge, inquiry skills, habits-of mind and critical thinking (NRC, 1996); and balance appropriately content structure, teacher structure and students' self-regulation to enhance learning. The NCTAF report states "students are entitled to teachers who know their subjects, understand their students and what they need, and have mastered the professional skill required to make learning come alive" (Darling-Hammond, 1996, p. 6). The report goes on to recommend that American education get serious about standards for teachers and students, teacher education and professional development be reinvented, teacher recruitment be overhauled, teaching knowledge and skills be encouraged and rewarded, and schools be reorganized as places for teaching and learning.

The NBPTS (1994) described a vision of effective teaching generally that contains five core propositions, and developed a national teacher certification program based on standards for these propositions (abstracted from pp. 6-8):

1. **Teachers are Committed to Students and Their Learning**

   Board-certified teachers are dedicated to making knowledge

accessible to "all" students. They act on the belief that "all" students can learn. They treat students equitably, recognizing the individual differences and taking account of these differences in their practice. They adjust their practices as appropriate, based on observation and knowledge of their students' interests, abilities, skills, knowledge, family circumstances, peer relationships and culture.

2. **Teachers Know the Subjects they Teach and How to Teach those Subjects to Students**

Board-certified teachers have a rich understanding of the subject(s) they teach and appreciate how knowledge in their subject is created, organized, linked to other disciplines and applied to real-world settings. While faithfully representing the collective wisdom of our culture and upholding the value of disciplinary knowledge, they also develop the critical and analytical capacities of their students.

They are aware of the preconceptions and background knowledge that students typically bring to each subject and of strategies and instructional materials that can be of assistance. They understand where difficulties are likely to arise and modify their practice accordingly. Their instructional repertoire allows them to create multiple paths to the subjects they teach, and they are adept at teaching students how to pose and solve their own problems.

3. **Teachers are Responsible for Managing and Monitoring Student Learning**

Board-certified teachers create, enrich, maintain, and alter instructional settings to capture and sustain the interest of their students

and to make the most effective use of time. They also are adept at engaging students and adults to assist their teaching and at enlisting their colleagues' knowledge and expertise to complement their own.

Accomplished teachers command a range of generic instructional techniques, know when each is appropriate, and can implement them as needed. They are as aware of ineffectual or damaging practice as they are devoted to elegant practice.

They know how to engage groups of students to ensure a disciplined learning environment, and how to organize instruction to allow the schools' goals for students to be met. They employ multiple methods for measuring student growth and understanding and can clearly explain student performance to parents.

4. Teachers Think Systematically about their Practice and Learn from Experience

Board-certified teachers are models of educated persons, exemplifying the virtues they seek to inspire students—curiosity, tolerance, honesty, fairness, respect for diversity and appreciation of cultural differences—and the capacities that are prerequisites for intellectual growth: the ability to reason and take multiple perspectives, to be creative and take risks, and to adopt an experimental and problem-solving orientation.

Accomplished teachers draw on their knowledge of human development, subject matter and instruction, and their understanding of their students to make principled judgments about sound practice. Striving to strengthen their teaching, Board-certified teachers critically examine their practice, seek to expand their repertoire, deepen their

knowledge, sharpen their judgment and adapt their teaching to new findings, ideas and theories.

5. **Teachers are Members of Learning Communities**

Board-certified teachers contribute to the effectiveness of the school by working collaboratively with other professionals on instructional policy, curriculum development and staff development. They can evaluate school progress and the allocation of school resources in light of their understanding of state and local educational objectives. They are knowledgeable about specialized school and community resources that can be engaged for their students' benefit, and are skilled at employing such resources as needed.

The *National Science Education Standards* (NRC, 1996) apply these assumptions about commitment to all students, effective teaching, knowledge expertise, organizational abilities, reflective practice, leadership and professionalism to the standard for science teaching and the standards for professional development required to achieve the desired teaching. The science standards describe the collective knowledge and actions needed for effective science teaching and the grade-appropriate knowledge and actions. The teaching standards address: (1) planning inquiry science programs, (2) actions required to guide and facilitate learning, (3) assessments of teaching and learning, (4) learning environments that promote learning, (5) communities of learners to support learning , and (6) planning and development of school-wide science programs. The professional development standards envision true professionalism and a seamless professional education system for science teachers that includes preservice, induction (early years of teaching), and continued professional education. The standards address: (1) learning science content through inquiry, (2) integrating content

knowledge, pedagogical knowledge into learner/topic appropriate content-pedagogical knowledge, (3) lifelong learning, and (4) coherence and integration of professional development programs. Clearly, the *National Science Education Standards* envision well-educated, flexible, reflective, professional teachers taking charge of their profession and responsibility for their self-directed enhancement.

Teaching is a complex endeavor involving a balancing act while juggling numerous factors. "The education challenge ... is not that its schools are not as good as they once were, it is that schools must help the vast majority of young people reach levels of skills and competencies once thought within the reach of a few. To help diverse learners master much more challenging content, teachers must go far beyond dispensing information, giving a test, and giving a grade." (Darling-Hammond, 1996, p. 8). The teaching envisioned by contemporary reforms is much more demanding on teachers and students requiring thousands of decisions and adjustments during each lesson (reflection-in-action) and analysis of teaching effectiveness after the lesson (reflection-on-action). Teaching is too complex to understand it totally; deconstructing teaching into separate components is dangerous, but it is necessary to explore the interacting parts to better understand the whole process (Figure 1).

Clearly, elementary school science education programs need to recognize the realities of schools, classrooms, and students while striving to produce new teachers that ascribe to the professional and science standards for teaching (Koballa, 1997; Pekarek, Krockover & Shepardson, 1996). The gap between the school and the university has to be overcome collaboratively and by being aware that the zone of free movement (ZFM), the zone of promoted action (ZPA), and the zone of proximal development (ZPE) may not be aligned for the preservice teacher, cooperating teacher, and science education professor

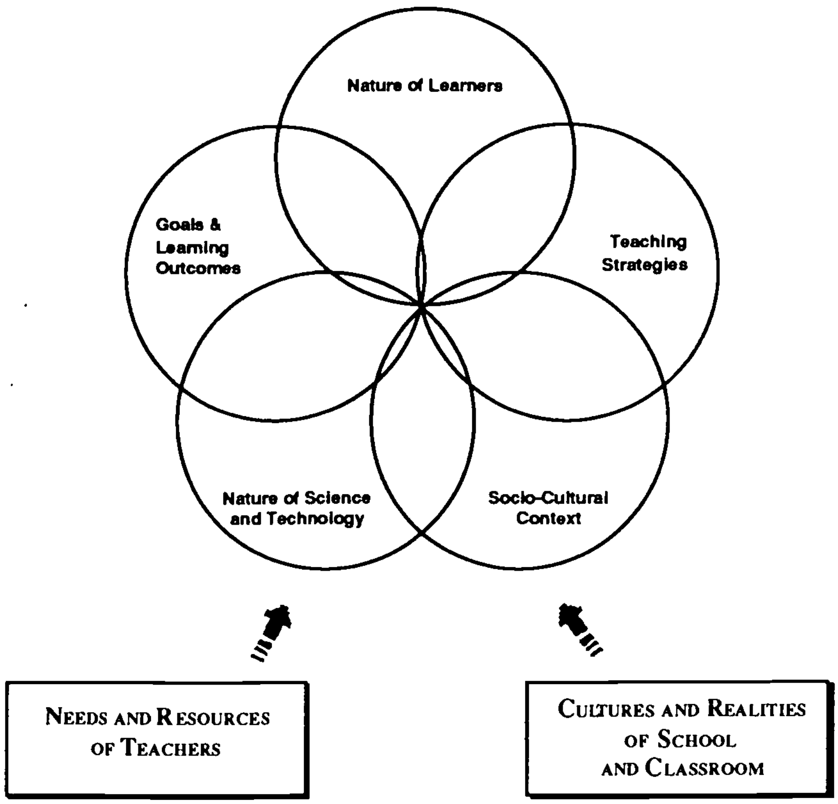
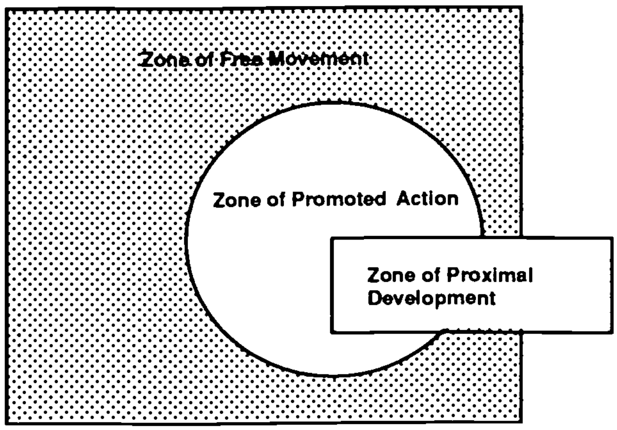


Figure 1: Compatability Model for Science Teaching and Learning

(Westbrook, Carter & Smith, in press). The ZFM is the teaching, assessment, and learning outcomes open to exploration for the student teacher defined by boundaries of school policies, safe practice, and professional ethics. The ZPA is the preferred exploration or desired practice defined by the cooperating teacher and science education professor. The ZPD is the developmentally appropriate teaching, assessment, and management strategies defined by the student's prior experience, risk level, and personal goals. Figure 2 illustrates the ideal alignment of these zones to promote professional development of preservice teachers. Realistically the alignment is somewhat less than ideal, since little effort is devoted to communicating and clarifying these ideas amongst university-based and field-based educators. Effective professional

development experiences should be crafted around narrowing the gap between university professors and classroom teachers.

Figure 2: Alignment of the Zones of Free Movement, Promoted Action and Proximal Development (Adapted from Westbrook, Carter & Smith, in press)



Finally, science education advocates and leaders are critically needed if the current science education reform is to be successful. Many good innovations and educational changes are not fully implemented because leadership is not provided at the target level (classrooms, teachers, students) or transferred from the innovators to the grassroots change agents. Leadership must be a central goal of science education programs, and therefore leadership training needs to be a part of undergraduate coursework. Leadership is illustrated by teachers taking on responsibility for curriculum committees, ordering equipment, providing mentorships for new teachers, active membership in science teacher organizations, writing professional articles, giving conference presentations, and conducting professional development workshops.

The University of Victoria's Elementary School Teacher Education Program

The University of Victoria is authorized by the British Columbia College of Teachers to offer elementary education programs that meet its standards. The regular program leads to a B.Ed. degree in five years. Most students enter after either one or two years of general-liberal academic courses in the Faculty of Arts and Sciences of a college or university. The third year is a pre-professional year with content, general pedagogical and limited methods (physical education, music, drama and art) coursework, and a two-week clinical experience at the end of the year. The fourth year is the professional year with further foundations and methods courses and the practica, which leads to certification. The fifth year may be done after teaching has begun and is designed to give teachers a concentration in a specific curricular area of their interest. Currently, most students stay onto complete the fifth year, since it provides a higher salary and teaching positions are presently in short supply.

Science Education

The science education component of the elementary teacher education program at the time of this study (1996-97) ranges from the basic core to two levels of specialization: a concentration and a teaching area (Figure 3).

Laboratory Science Requirements

The core science education requirements are 3 to 4.5 units (1.5 units = 3 semester hours or 4.5 quarter hours) of laboratory science and 2 units of science methods. The most popular electives to fulfill the laboratory science requirements are SNSC 145A, SNSC 145B, and SNSC 145C. These content courses were designed by the Department of Social and Natural Sciences to provide a non-calculus, conceptual, hands-on/minds-on orientation to understanding physical science, earth-space science, and biological

science concepts. These courses focus on specific content knowledge embedded in the provincial elementary school science curriculum (K-7) and the professor's attempt to demonstrate the desired constructivist pedagogical strategies.

Figure 3: Science Education Component of the Elementary B.Ed. Program

ELEMENTARY SCIENCE EDUCATION PROGRAMS
University of Victoria

	Core	Concentration	Teaching Area
Year 1/2	* 3 - 4.5 units University Lab Science	* 3 - 4.5 units University Lab Science	* 3 - 4.5 units University Lab Science

* If Grade 11/12 Science, requirement reduced. Most frequent courses SNSC 145A (1.5) - Physical Science, SNSC 145B (1.5) - Earth Science, SNSC 145C (1.5) - Biological Science

	Core	Concentration	Teaching Area
Year 3	None	**SNSC 345B (1.5)** Science-Technology Society Issues in Science Education	**SNSC 345B (1.5)** Science-Technology Society Issues in Science Education
		SNSC 373 (1.5) Environmental Education	**SNSC 373 (1.5)** Environmental Education
		SNSC 345A (1.5) Selected Topics in General Science	**SNSC 345A (1.5)** Selected Topics in General Science
Year 4	**ED-E 745 (2)** Curriculum & Instruction in Elementary Science	**ED-E 745 (2)** Curriculum & Instruction in Elementary Science	**ED-E 745 (2)** Curriculum & Instruction in Elementary Science
Year 5	None	**ED-E 438A (1.5)** Computer Applications in the Instruction of Elementary Math, Science and Social Studies	**ED-E 438A (1.5)** Computer Applications in the Instruction of Elementary Math, Science and Social Studies
		ED-E 445A (1.5) Science Instruction in the Elementary School	**ED-E 445A (1.5)** Science Instruction in the Elementary School
		ED-E 445B (1.5) Contemporary Issues in Elementary Science Curriculum	**ED-E 445B (1.5)** Contemporary Issues in Elementary Science Curriculum
		ED-E 473 (1.5) Environmental Issues in Education	**ED-E 473 (1.5)** Environmental Issues in Education
	Core = 5 - 6.5 units	Other Sciences	Other Sciences
TOTAL		Core + 9 units	Core + 15 units

1.5 units equals 3 semester hours or 4.5 quarter hours

Science Methods

The required elementary school science methods course (ED-E 745) meets 50-54 hours during 19 weeks spread over two semesters or concentrated during six weeks depending on the specific program. Student teaching experiences (practica) are embedded in the last six weeks (November-December) of the first semester and in the final six weeks (April-May) of the second semester during the regular program or the science methods course is embedded midway (November-December) during a year-long internship program. The philosophy of science education methods is heavily influenced by the contemporary science education reforms and applied cognitive science, and curriculum and instruction are linked to an interactive-constructive perspective of teaching and learning (Shymansky, Yore, et al., 1997). ED-E 745 attempts to develop knowledge and teaching strategies regarding the philosophical and psychological foundation of the science curriculum and instruction, the goals of the curriculum, inquiry skills, and authentic assessment. Contemporary articles from professional journals (*BC Catalyst, Science Scope, Science and Children*, etc.) and provincial curriculum documents (*Integrated Resource Package: Science K-7*, etc.) are used to elaborate the classroom activities and discourse. Most often the educational idea under consideration is used to demonstrate the idea itself. Therefore, activities from the provincially recommended curriculum materials that are interesting and challenging to adult learners are used to illustrate the attributes of the inquiry-oriented curriculum; and instructional strategies are modeled prior to being discussed. Considerable planning takes place to ensure that students have had concrete experience with an idea before the idea is formally discussed and potential classroom applications and associated teaching strategies are described. The practica provide authentic context to apply these ideas.

Science Education Specialization

The "concentration" in science requires a further 9 units (6 courses) of science content and science content-pedagogical courses over and above the core requirements. The "teaching area" in science requires a further 15 units (10 courses) of science content and science content-pedagogical courses over and above the core requirements. Students may elect from a variety of content courses in Earth and Ocean Sciences, Environmental Studies, Chemistry, Physics, Biology, and Biochemistry. Students must complete upper-level STS, technology applications, advanced instruction, and advanced curriculum courses.

The Action Research Focus

Course Content

ED-E 445A: Science Instruction in the Elementary Schools is a 1.5 unit course focused on advanced science instruction (teaching and assessment) in kindergarten to grade 7. The course meets 3 hours per week during spring term and normally serves as the keystone course in the science concentration and teaching area for 10-15 students per year. ED-E 445A is designed to provide science education students with:

1. awareness of provincial, national and international trends in science education and science literacy.
2. knowledge and sensitivity to factors influencing the selection of instructional strategies, i.e., Nature of Science, Nature of learner, Desired outcomes, Available resources, Classroom and school environments, others.
3. knowledge about and skills related to specific instructional strategies.
4. ability to select, develop, implement and justify the use of specific instructional strategies.
5. leadership skills related to improving science instruction.

The seminar nature of the course allows the professor to personalize the course and to utilize a variety of human and instructional resources. Recently the *National Science Education Standards* (NRC, 1996), reprints from *Science and Children*, *Science Scope* and other professional journals, and reference articles and textbook (placed on reserve in the Curriculum Library) have served as the print supplements for the course. The following tentative topic outline and assignments were used in 1997:

<u>Topics</u>

I The Private Universe and *Times-Colonist* Article on Adult Science Literacy
Making a Difference as a Science Teacher
Nature of Science, Technology and Social Studies; Science Literacy; and Multiculturalism

II Science Education in North America and B.C.
a. NSTA Scope, Sequence and Coordination
b. AAAS Science for All Americans and Benchmarks for Science Literacy
c. NRC Standards (pp. 1 - 26)
d. BC Science Integrated Resource Package for Science (K-7)
e. Pan Canadian Framework for Science (1996 Working Draft)

III The Many Faces of Constructivist Teaching/Learning (NRC, 1996, pp. 27 - 54)
a. Information Processing
b. Teacher-Guided Inquiry
c. Conceptual Change
d. Interactive-Constructive
e. Social Constructivist
f. Radical Constructivist

IV Assessment Alternatives (NRC, 1996, pp. 75 - 103)
a. Performance Tasks and Scoring Rubrics
b. Concept Mapping and Scoring Procedures
c. Think Alouds
d. Negotiated Criteria

V Content Standards (NRC, 1996, pp. 103 - 172)
a. K - 4 Content Standards
b. 5 - 8 Content Standards
c. Analysis of B.C. Science Integrated Resource Package for Science (K - 7)
d. Exploring New Curriculum Resources (FOSS, AIMS, STC, Insights)

VI Basic Inquiry Teaching and Learning Approaches

a. Generative Approach
b. Learning Cycle
c. Conceptual Change
d. Promoting Social Discourse
e. 4-part Teaching Strategy

VII Science Instruction Utilizing Alternative Approaches (Student-Presented Workshops)

a. Guided Imagery
b. Role Playing
c. Games
d. Stimulations
e. Models, Analogues and Metaphors
f. Peer Teaching and Learning
g. Cooperative Learning
h. Structured Controversy
i. Case Studies
j. InterNet
k. Computer Assisted, Microcomputer-Based Laboratory, etc.
l. Projects
m. Science Camps: Science Venture, CRD Parks, Swan Lake
n. Science Fairs
o. Problem Solving: Science Odyssey, Invention Conventions, Science Olympics
p. Others

VIII Reading-to-Learn: Explicit Content Reading Instruction in Science

a. General Plans
b. Teaching Sequence: Do First, Read Later
c. Strategy Development Embedded in Authentic Inquiry

IX Writing-to-Learn: Content Writing Activities in Science

<u>Assignments</u>

1. Term Paper
A ten-page position paper on an assigned topic. The paper will include 10-15 references. Your expert-group composed of students with the same topic will share ideas and resources, while the other expert-groups will provide reactions and editorial feedback on drafts #1 and #2 of your paper. The instructor will grade draft #3. A draft #4 will be allowed for those students wishing to improve their grade.

Topics:

A. Nature of science, social studies, mathematics and technology. How should they influence what we teach and how we teach Elementary School science.
B. Multi-culturalism. How should it influence what we teach and how we teach Elementary School science.
C. Cross-curricular aspects of literacy and a conceptual framework for science literacy. (30 points)

2. Class Presentation
A 30-minute workshop on an instructional strategy (see topic VII). A substantive class hand-out that provides description, research support and application of the strategy is required. (20 points)

3. Teaching Internship in Science
A three-week science teaching project at an elementary school (TBA). Two students will work with a classroom teacher to identify, develop and deliver a science unit consisting of 6-10 hours of instruction and evaluation. (30 points)

4. Examination
Two (2) hour comprehensive examinations. A pool of questions will be provided in advance and the examination will be selected from these questions. (20 points)

Leadership Component

ED-E 445A attempts to develop science education leadership in five ways: Knowledge about science education reforms, curricula, instruction, and assessment; communication skills (oral and written); workshop experience; collaborative planning; and reflective practice. All assignments except the final examination address these issues. The specific focus of this action research was the teaching internship in science.

Students in this course hold or could hold a Standard Teaching Certificate (Level 4) since they have successfully completed their student teaching and four years of post-secondary education. In fact, many of the students are serving as teacher-on-call (TOC) in local school districts while completing their year five course work. This means that they are well informed about science education in local schools and are somewhat more self-confident, futuristic and risk-takers than most preservice students. They realize that

not everything addressed in the course will be usable the next day and that some of the benefits of the course will be realized as they become practicing teachers. Legally these students can assume teaching responsibilities for a group of students with much less supervision than normal student teachers.

With such students several activities are possible that may not be practical with other students—collaborative essay writing (Yore, 1996) negotiated criteria for and peer evaluation of student-led workshops (Yore, 1998) and science teaching internships. The collaborative writing task has enhanced students' writing ability and their willingness to publicize their ideas. The negotiated criteria and workshop task has clarified the understanding of effective professional development and their oral presentation skills. Collectively these assignments are designed to enhance their vision of a professional community willing to share and reflect on practice and to accept the responsibility for their professional growth.

The science internship was designed to enhance their teaching strategies, increase their reflective practice and enhance the cooperating teachers' understanding about science reform and expectations for science teaching. The host school principal and volunteer host teachers had agreed with the university professor to maximize the zone of free movement and the zone of promoted action. The expanded opportunities were possible because the interns were certified teachers with strong content background and the enhanced science experience was a benefit to the elementary school students. This is accomplished by locating a volunteer school and staff who believe there are mutual gains from the proposed experience and have expressed a willingness to explore innovations in science instruction.

The 1997 school was entering its regular provincial review and certification procedure, and staff members were looking for opportunities to document and enhance their teaching. The design of science teaching internship required that pairs of students negotiate a science topic and time schedule with the host school and host teacher. Once

the topic and time constraints were clarified, the interns, classroom teacher and university professor collaborated to plan a science unit of 6-9 lessons, formative evaluations and summative evaluation. Topics selected in 1997 were: Gases and Air (Grade 1), Rolling Objects (Grades 1-2), Rocks and Minerals (Grades 2-3), Earth's Composition (Grade 3), Simple Machines (Grade 4), and Weather (Grade 5).

The interns collaborated to develop tentative unit overviews, explored curricular materials, and developed potential strategies utilizing the resources of the school and university. Tentative plans were discussed with the host teacher and revisions were suggested. The results of the interns and teacher deliberations were reviewed by the professor with adjustments being negotiated with the classroom teacher. A central part of these discussions was to anchor instructional decisions to the science education reform, provincial curriculum and effective teaching documents. The resulting science units and teaching strategies were custom-designed for the students in the class and the interns. Students who lacked confidence and experience selected somewhat more teacher-structured inquiry approaches while the more confident risk-takers selected rather innovative approaches. The negotiations and curriculum planning took about three weeks.

Collaborative planning provided an authentic problem-centered context for the interns, professor and host teacher to share insights and to educate one another. The central themes of the new science curriculum and reforms (science literacy, constructivism, authentic assessment, etc.) were discussed in light of the realities of mainstream students, little equipment, loaded daily schedule, and teacher anxiety toward science. Interns, teachers and professor developed better understanding of each other's culture.

The interns were generally encouraged to push the boundaries of their expertise and to try new and different teaching and assessment strategies in an authentic context. All interns utilized hands-on inquiries. They utilized learning cycles, guided inquiry,

models to illustrate abstract concepts and processes, small-group cooperative approaches, writing to learn science, children's literature, trade books and authentic assessments (interviews, performance tasks and observational checklists).

Interns co-taught the unit with one student serving as an observer while the other student did the teaching. During activities both interns were involved with the small groups to enhance and direct the discourse. The university professor observed about 50% of all lessons. After the lesson was over, the interns, professor and teacher were involved in post-instructional discussions designed to encourage reflection-on-practice. The richness and effectiveness of peer-discussions were under-estimated and require further exploration.

Results and Reflections

The effectiveness of the internship was documented with instructional artifacts produced by the interns (unit plans, lesson plans, class hand-outs), professors' journal notes and classroom observations, school principal and classroom teacher comments, and course evaluation comments. Qualitative analyses of these data sources revealed that the positive benefits of this internship are an improved relationship with the school, enhanced self-concept and teaching effectiveness of interns, a professor who can describe the teaching effectiveness of all elementary school science majors, and informal professional development for classroom teachers and professor. The negative aspects of the internship were that not all peer-pairs were effective collaborators, the school experience placed significant time demands on university students and professor, professional development experiences could be more formalized, and follow-up activities should be planned.

Student comments on the course evaluation clearly illustrate both the positive and negative aspects of the internship:

A. Quality experience and time demands.

- *Good experience, but time consuming trying to get together with partner.*
- *Fun to be in classes—fair that class ends early (in term).*
- *The teaching takes up lot of time and effort for what it's worth. Maybe 3 weeks is too long.*
- *Great idea—3 weeks isn't very long though to teach a full unit adequately. I almost wish there had been more time alloted for this activity.*
- *Continue—longer duration possibly 4 weeks.*

B. Quality experience, self-directed and leadership

- *Fantastic experience; crucial to beginning teachers, very valuable!*
- *Enjoyable! Once again, time was an issue. But getting out and getting new ideas, practice and feedback on Science teaching is invaluable.*
- *Very useful. The limited unit allowed us to focus on specifically teaching science and its unique problems.*
- *Definitely a good experience. I liked that you had us set a goal for our final week(s).*
- *It feels good to be a science specialist entering a school, however, it's difficult to team teach.*

C. Need for more front-end experiences.

- *Good experience although very time consuming. I appreciate that you included this time in the course hours.*
- *I would have liked more teaching about constructivism and goals we should have for the internship before beginning planning. I don't feel we spent enough time talking about how you wanted us to teach. We needed to spend more time discussing what to teach.*

Analysis of unit plans, lesson plans, and classroom observations confirmed the above assertions. Clearly the internship was demanding of the university students' time, which was compounded by their commitment to other course work. The specialized focus of the internship on science provided an excellent opportunity for interns and professor to concentrate on constructivist ideas that are not promoted in other content areas during general clinical experiences. Several interns explicitly assessed and used children's ideas about science to plan lessons and to monitor conceptual growth and change. Every intern pushed their zone of proximal development utilizing inquiry-oriented approaches and provided supportive scaffolding for the children that was within the limits of their expertise. One pair of interns exclusively used physical and anological models to explore geological processes. Clay, food coloring, vinegar, and baking soda were used to illustrate a volcano, toothpaste became lava, a compressed peanut butter, jelly and raisin sandwich represented a sedimentary rock formation, and a grilled cheese sandwich pressed in a sandwich maker became a metamorphic rock formation.

The single most important thing was the reality training provided an experienced professor. The collaborative planning refreshed my understanding of being a novice teacher and a generalist classroom teacher responsible for the total school curriculum. The in-class observations have demonstrated the unique demands on teachers by a rapidly changing curriculum, limited resources, and mainstreamed students.

In total, the internship was useful to all involved, but continued efforts are needed to manage and control the time demands and to improve the effectiveness of the professional development. In the future student's class schedules will be designed to free two afternoons per week for school-based experiences. The professional development of the host teachers will become a more overt agenda of the internships.

Host schools will be required to establish two or three workshops to enhancing their science programs.

References

Darling-Hammond, L. (1996). What matters most: Teaching for America's future (Summary Report). New York, NY: The National Commission on Teaching & America's Future.

Kennedy, M.M. (1990). Choosing a goal for professional education. In W.R. Houston (Ed.), *Handbook of research on teacher education* (pp. 813-825), New York, NY: MacMillan.

Koballa, T. (1997). Two communities: One challenge. NARST News, Summer, 3-4.

NBPTS (1994). What teachers should know and be able to do. Detroit, MI: National Board for Professional Teaching Standards.

NRC (1996). *National Science Education Standards*. Washington, DC: National Academy Press.

Pekarek, R., Krockover, G.H. & Shepardson, D.P. (1996). The research-practice gap in science education. *Journal of Research in Science Teaching*, 33, 111-113.

Roth, R.A. & Pipho, C. (1990). Teacher education standards. In W.R. Houston (Ed.), *Handbook of research on teacher education* (pp. 119-135), New York, NY: Macmillan.

Shulman, L.S. (1987). Knowledge and teaching: Foundations of new reforms. *Harvard Education Review*, 57, 1-21.

Shymansky, J.A., Yore, L.D., Treagust, D.F., Thiele, R.B., Harrison, A., Waldrip, B.G., Stocklmayer, S.M. & Venville, G. (1997). Examining the construction process: A study of changes in level 10 students' understanding of classical mechanics. *Journal of Research in Science Teaching*, 35, 571-593.

Westbrook, S.L., Carter, G. & Smith, R. (in press). When cultures collide: Teaching in someone else's classroom. In J. Valsiner & A. Branco (Eds.). *Communication and Metacognition*. Norwood, NJ: Ablex.

Yager, R.E. & Penick, J.E. (1990). Science teacher education. In W.R. Houston (Ed.), *Handbook of research on teacher education*, (pp. 657-673), New York, NY: Macmillan.

Yore, L.D. (1996). Writing to learn science strategies with preservice elementary teachers. In P. Rubba, P. King & J. Rye (Eds.) Annual International Conference of the Association for the Education of Teachers in Science (pp. 25-56). *Resources in Education* (ED 398060). Proceedings of the 1996 AETS Meeting.

Yore, L.D. (1998). Using negotiated criteria and peer-evaluation in elementary science education. Paper to be presented at the 1998 Annual International Conference of the Association for the Education of Teachers in Science. Minneapolis, MN, January 8-11.

SE061013

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

ERIC

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Leadership Interns in Undergraduate Elementary School Science Education Programs

Author(s): Larry D. Yore

Corporate Source: University of Victoria

Publication Date: November 13, 1997

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic/optical media, and sold through the ERIC Document Reproduction Service (EDRS) or other ERIC vendors. Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce the identified document, please CHECK ONE of the following options and sign the release below.

☑ Sample sticker to be affixed to document

Sample sticker to be affixed to document ☐

Check here

Permitting microfiche (4" x 6" film), paper copy, electronic, and optical media reproduction

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Level 1

"PERMISSION TO REPRODUCE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Level 2

or here

Permitting reproduction in other than paper copy

Sign Here, Please

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but neither box is checked, documents will be processed at Level 1.

"I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce this document as indicated above. Reproduction from the ERIC microfiche or electronic/optical media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries."

Signature: Larry D. Yore	Position: Professor
Printed Name: LARRY D. YORE	Organization: University of Victoria
Address: Dept. of Social & Natural Science Box 3010 Victoria BC V8W 3N4	Telephone Number: 250-721-7787
	Date: Nov. 20, 1997

Over

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of this document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents which cannot be made available through EDRS).

Publisher/Distributor:	
Address:	
Price Per Copy:	Quantity Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant a reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name and address of current copyright/reproduction rights holder:

Name:

Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

If you are making an unsolicited contribution to ERIC, you may return this form (and the document being contributed) to:

ERIC Facility
1301 Piccard Drive, Suite 300
Rockville, Maryland 20850-4305
Telephone: 301-258-5500
Fax: 301-948-3695
800: 800-799-ERIC (3742)
Internet: ericfac@inet.ed.gov